BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA

In the Matter of:	)	**SURREBUTTAL TESTIMONY OF**
Application of Dominion Energy South	)	**ZHEN ZHU**
Carolina, Inc. for Adjustment of Rates and	)	**For United States Department of**
Charges,	)	**Defense and All Other Federal**
Docket Number 2020-125-E	)	**Executive Agencies**

December 17, 2020

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DOCKET NO. 2020-125-E

EXHIBIT No. __(ZZ Surrebuttal) SCHEDULES

SURREBUTTAL TESTIMONY

OF ZHEN ZHU, Ph.D.

ON BEHALF OF UNITED STATES DEPARTMENT OF DEFENSE AND ALL

OTHER FEDERAL EXECUTIVE AGENCIES

BEFORE SOUTH CAROLINA PUBLIC SERVICE COMMISSION

DOCKET NO. 2020-125-E

1   I.   <u>INTRODUCTION</u>

2

3   Q.   PLEASE STATE YOUR NAME, POSITION AND BUSINESS ADDRESS.

4   A.   My name is Zhen Zhu. I am a Managing Consultant. My business address is

5   5555 North Grand Blvd., Oklahoma City, Oklahoma 73112.

6   Q.   BY WHOM ARE YOU EMPLOYED?

7   A.   I am employed by C. H. Guernsey & Company. I am also the Dr. Michael

8   Metzger Chair Professor of Economics at the University of Central Oklahoma.

9   Q.   ARE YOU THE SAME ZHEN ZHU WHO PROVIDED DIRECT

10   TESTIMONY IN THIS PROCEEDING?

11   A.   Yes, I am.

12   Q.   WHAT IS THE PURPOSE OF YOUR SURREBUTTAL TESTIMONY?

13   A.   I have been asked by the United States Department of Defense and All Other

14   Federal Executive Agencies (DoD/FEA) to review and provide responses to the

15   rebuttal testimonies and recommendations of Dominion Energy South Carolina

16   (DESC or the Company) witnesses Steven M. Fetter and Dr. James Vander

17   Weide regarding capital structure, cost of debt, and cost of equity. Mr. Fetter

18   provided rebuttal testimony regarding the capital structure of the Company in

1   an attempt to refute my recommendation of 52.56% equity - 47.44% debt

2   capital structure. He also responded to the recommendations of witnesses for

3   other intervening parties. Among the other witnesses, Aaron Rothschild (on

4   behalf of the South Carolina Department of Consumer Affairs) and Dr. J.

5   Randall Woolridge (on behalf of the South Carolina Office of Regulatory Staff)

6   both recommended a capital structure for DESC of 50% equity and 50% debt.

7   Dr. Vander Weide provided responses to my return on debt and return

8   on equity recommendations and my criticism of his Return on Equity (ROE)

9   methodologies and results. He also updated his ROE study to include capital

10   market results through October 31, 2020 to reflect the more recent capital

11   market developments. His base ROE has declined from 9.8% to 9.7%, and the

12   "financial risk" adjusted ROE has declined from 10.4% to 10.3%.

13 Q. IS THERE ANYTHING IN THE TESTIMONIES OF MR. FETTER AND DR.

14   VANDER WEIDE THAT WOULD CAUSE YOU TO CHANGE YOUR

15   RECOMMENDATIONS?

16 A. No, there is not. I continue to recommend a 52.56% equity, 47.44% debt capital

17   structure and a ROE of 9.1%.

18 Q. ARE YOU SPONSORING ANY EXHIBITS?

19 A. Yes, I am sponsoring the following exhibits:

20   Exhibit No.___(ZZ-1 Surrebuttal):   RP ROE Estimation with 1449 Cases

21   Exhibit No.___(ZZ-2 Surrebuttal):   Replication of JVW Rebuttal Table 9

22   Exhibit No.___(ZZ-3 Surrebuttal): Method to Estimate the Relationship

23   Between Risk Premium and Interest Rate

1   Exhibit No.___(ZZ-4 Surrebuttal): Analysis of JVW ROE update

2

3   II. SURREBUTTAL OF THE COMPANY WITNESS STEVEN FETTER

4
5   Q.   DID MR. FETTER MAKE A DIFFERENT RECOMMENDATION

6   REGARDING THE COMPANY'S CAPITAL STRUCTURE THAN

7   PROPOSED IN THE ORIGINAL FILING?

8   A.   No, Mr. Fetter did not make a different capital structure recommendation. He

9   supported the Company's request of 53.35% Equity/46.65% Debt.

10   Q.   HOW DID MR. FETTER MAKE HIS ARGUMENT?

11   A.   Mr. Fetter explained the credit rating processes and the financial community

12   perception of the South Carolina Public Service Commission (Fetter Rebuttal,

13   Section IV, pages 16-18). He concluded (Fetter, page 18, lines 13-15):

14   Importantly, the key assumptions Fitch has factored into its
15   current BBB+ [Stable] rating are "maintenance of DESC's
16   capital structure in line with regulatory capital structure," and
17   a constructive 2021 base rate decision.
18

19   Q.   HOW DO YOU VIEW HIS STATEMENT IN THE CONTEXT OF THIS

20   RATE CASE?

21   A.   In principle, I agree with Mr. Fetter's statement; however, we differ in specifics.

22   Q.   IN WHAT SPECIFICS DO YOU DIFFER?

23   A.   Mr. Fetter stated "I believe the Company's proposed capital structure at 53.35%

24   - 46.65% equity/debt, 79 basis points above Dr. Zhen's recommendation, is

1   deserving of Commission support in that it is based on current actual data"

2   (Fetter rebuttal, page 21, lines 17-19).

3   In contrast, I believe that the Company's requested equity ratio is too

4   high. Aside from the fact that the Company did not follow the test year

5   requirement to set the capital structure, the Company's request of 53.35% is

6   much higher than the equity ratio of the utilities in the proxy group. As I have

7   shown in Exhibit No.___ (ZZ-3) of my direct testimony, the proxy group's

8   average equity ratio is in the range of 47 to 48%.

9 Q. WHAT REASONING DID MR. FETTER GIVE FOR MAINTAINING AN

10   EQUITY RATIO AT THE CURRENT LEVEL?

11 A. Mr. Fetter claimed that maintaining an equity ratio at the current level is

12   important to maintain the current DESC credit rating. He further stated on page

13   21, lines 19-22 of his rebuttal that "Company maintenance of that level would

14   be consistent with rating agency assumptions as recently noted by Fitch, and

15   such increment in equity level should allow for continued improvement in the

16   Company's credit profile, with a goal of the Moody's rating joining S&P and

17   Fitch at the BBB+ / Baa1 level."

18 Q. DO YOU AGREE WITH HIS STATEMENT?

19 A. No, I do not. Even though equity ratio is a factor in the consideration of credit

20   ratings, equity ratio does not dictate the absolute level of credit ratings. Table 1

21   below shows the credit ratings of all electric utilities in *Value Line* and average

22   equity ratios for each notch of ratings by Moody's and S&P.

1   Several observations can be drawn from Table 1. First, there is no clear

2   connection between the average equity ratio and credit ratings. For example,

3   the average equity ratio for Moody's Baa1 rating is 48.81% equity while the

4   equity ratio for the higher notch rating of A3 is lower, at 47%. If the objective

5   of raising the Company's credit rating to S&P's next level (A3) as suggested

6   by Mr. Fetter, an equity ratio consistent with 47% would be sufficient, given

7   everything else satisfies the rating agency's requirements. Second, the

8   Company's equity ratio at the end of 2019 is already much higher than the

9   utility companies' average equity ratios for the corresponding ratings groups. I

10   do not see a valid point of asking the Commission to set a higher hypothetical

11   equity ratio just for the sake of satisfying the requirements of the rating

12   agencies. Instead, granting a higher hypothetical equity ratio will lead to higher

13   cost of capital than necessary, putting unnecessary burdens on consumers.

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1   Table 1. Credit Ratings and Equity Ratio

No. of Utilities	Equity Ratio 2020	Expected Equity Ratio 2021	2023-2025	Moody's
1	66.00	66.00	63.50	A1
2	47.25	46.75	47.00	A3
13	49.46	49.23	48.81	Baa1
16	45.19	45.84	46.91	Baa2
4	39.5	38.625	41	Baa3
DESC Rating				Baa2
One notch higher				Baa1
One notch lower				Baa3

No. of Utilities	Equity Ratio 2020	Expected Equity Ratio 2021	2023-2025	S&P
15	47.43	47.27	47.37	A-
12	44.42	45.33	46.63	BBB+
6	47.42	46.17	47.08	BBB
1	52.00	53.00	51.50	BBB-
DESC Rating				BBB+
One notch higher				A-
One notch lower				BBB

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3   Q.   CAN YOU SUMMARIZE YOUR SURREBUTTAL OF MR. FETTER'S

4   TESTIMONY?

5   A.   Yes. I believe Mr. Fetter's arguments for setting a high equity ratio to satisfy

6   the rating agencies' requirement to maintain or improve the current credit

7   ratings of the Company is flawed and not supported by the facts. The

8   Company's 2019 test year equity ratio is already in the range that was ordered

1   by the Commission and is already higher than the average equity ratio of the

2   proxy group.

3

4   III. SURREBUTTAL OF COMPANY WITNESS DR. JAMES VANDER

5   WEIDE'S COMMENTS ON MY ROE MODELING

6

7   Q.   DID DR. VANDER WEIDE'S REBUTTAL TESTIMONY ALSO ADDRESS

8   YOUR DIRECT TESTIMONY?

9   A.   Yes. Dr. Vander Weide commented on each of my ROE methodologies and

10   then responded to my criticism of his ROE calculations and adjustment.

11   Specifically, he commented on my position on the Company's cost of debt and

12   my calculation of ROE using the DCF, CAPM and RP methods. Furthermore,

13   he responded to my criticism of his methodologies in five general areas: use of

14   interest rate forecasts; EPS growth forecasts in the DCF analysis; flotation cost;

15   comparative earnings analysis; and market value capital structure (his

16   "financial risk") adjustment. I will provide a surrebuttal with respect to each of

17   these issues.

18   A.   Cost of Debt

19   Q.   DID YOU PERFORM ANY INDEPENDENT ANALYSIS OF THE

20   COMPANY'S COST OF EBT?

21   A.   No, I did not. I only used the Company-provided cost of debt value of 6.46% in

22   order to calculate the overall cost of capital.

23   B.   DCF Analysis

1 Q. PLEASE EXPLAIN DR. VANDER WEIDE'S POSITION WITH RESPECT

2   TO YOUR DCF ANALYSIS.

3 A. Dr. Vander Weide has several disagreements with my DCF analysis. He did not

4   agree with my use of the annual dividend model (JVW Rebuttal, page 80);

5   furthermore, he objected to my use of GDP growth rate in a two-step DCF

6   model (JVW Rebuttal, page 93); and he pointed out that I should have

7   calculated the long-term GDP growth rate as equal to 4.17% (JVW Rebuttal,

8   page 82). He also took issue with me not including flotation costs in the

9   calculation of ROE by the DCF method (JVW Rebuttal, page 82).

10 Q. DO YOU AGREE WITH DR. VANDER WEIDE'S CRITICISM OF YOUR

11   DCF MODEL?

12 A. I do not agree with Dr. Vander Weide on most of the points including the

13   quarterly versus annual dividend model, how to measure sustainable growth

14   rate, and flotation cost. I do agree with him that the GDP growth rate should

15   have been calculated as 4.17% instead of the 4.09% in my direct testimony due

16   to using EIA 2024 data rather than 2023 data. However, the effect of the GDP

17   growth rate calculation does not materially affect the DCF calculation of ROE.

18   I have used two versions of the DCF model: a one-step DCF model, which uses

19   only analysts' forecasts of earnings growth rate and a two-step DCF model,

20   which uses a weighted average growth rate of analysts' forecast and GDP

21   growth rate. GDP growth rate does not affect the one-step DCF model. With

22   GDP growth rate of 4.17%, the two-step DCF model yields a ROE of 8.50%

23   instead of the 8.49% as reported in my direct testimony.

1   I will address the issues of measurement of sustainable growth rate and

2   flotation cost in the section dealing with Dr. Vander Weide's response to my

3   criticisms.

4 Q. WHY DO YOU DISAGREE WITH DR. VANDER WEIDE REGARDING

5   USE OF THE QUARTERLY DIVIDEND MODEL IN THE DCF

6   ANALYSIS?

7 A. The correct way to is to use the annual dividend model. The quarterly dividend

8   is annualized by summing the four quarterly dividends or multiplying the last

9   quarterly dividend by 4.

10 Q. WILL YOU EXPLAIN FURTHER?

11 A. The quarterly dividend model compounds the quarterly dividend as Dr. Vander

12   Weide showed in his direct testimony. When investors receive a quarterly

13   dividend, they may choose to make additional investments with the dividend or

14   choose not to invest the dividend at all. This investor behavior should not be

15   mandated onto the dividend-issuing company as the company has no obligation

16   to compensate the investors for their investment decisions regarding the already

17   issued dividends. Thus, the quarterly dividend model, as illustrated by Dr.

18   Vander Weide, compensates investors in addition to the possible return that

19   they may have when they decide to invest quarterly dividends.

20 C.   CAPM Analysis

21 Q. HOW DID DR. VANDER WEIDE'S CAPM MODEL DIFFER FROM YOUR

22   VERSION OF THE CAPM MODEL?

1   A.   Dr. Vander Weide's CAPM model differs from mine in several areas: (1) the

2   use of risk-free rate. I used the actual 6-month average yields to the 30-year

3   Treasury bond yield while Dr. Vander Weide used forecasted interest rates from

4   *Value Line* and EIA. (2) We differ in the use of market risk premium. I only

5   used a version of forward-looking risk premium by applying a DCF model to

6   the S&P 500 dividend paying companies. In comparison, Dr. Vander Weide

7   used a forward-looking risk premium in addition to the risk premium generated

8   from historical stock market data. Dr. Vander Weide's forward looking model

9   is very similar to my model except, again, the use of the interest rate. (3) We

10   differ regarding the use of the flotation cost. While Dr. Vander Weide added 20

11   basis points to his ROE result, I argued against the use of flotation cost.

12   Q.   HOW DID YOUR RESULTS OF CAPM ANALYSIS DIFFER?

13   A.   My average CAPM result is a 9.72% ROE, while Dr. Vander Weide's ROE

14   ranges from 9.5% to 10.8% from his updated CAPM analysis. As I have pointed

15   out in my direct testimony, one of the driving factors in the relatively high

16   CAPM result is the high beta values of the utility companies after the start of

17   the COVID pandemic. As the U.S. economy starts to recover from the

18   pandemic, I expect the beta values of the electric utility companies would go

19   down, leading to lower ROE results from the CAPM analysis.

20   Q.   DID DR. VANDER WEIDE NOT AGREE WITH YOUR CAPM ANALYSIS

21   IN HIS REBUTTAL TESTIMONY? IF SO, IN WHAT AREAS?

1   A.   Dr. Vander Weide did not agree with my CAPM analysis completely as I had

2   not included flotation costs. In addition, my use of current interest rates instead

3   of the forecasted interest rate is not consistent with his study.

4   Q.   WILL YOU CHANGE YOUR CAPM ANALYSIS IN THE PRESENCE OF

5   DR. VANDER WEIDE'S DISAGREEMENT?

6   A.   No, I will not change my CAPM analysis, as I believe the correct

7   implementation of interest rate should be the current long-term interest rate and

8   it is not reasonable to include flotation costs in the CAPM analysis, which I

9   discuss in a later section.

10   D.   Risk Premium Model

11 Q.   WHAT IS THE RISK PREMIUM MODEL?

12 A.   The risk premium model is based on the financial principle that investors should

13   earn higher returns on equity (equity risk premium) compared to making an

14   investment in less risky or risk-free debt instruments. Therefore, the ROE by

15   the risk premium method has two parts in it - a risk premium and a risk-free

16   interest rate. The risk premium is derived from the difference between return

17   on equity and interest rate.

18 Q.   DID DR. VANDER WEIDE DESCRIBE YOUR RISK PREMIUM

19   ANALYSIS CORRECTLY?

20 A.   Dr. Vander Weide mischaracterized my use of interest rate for each case. He

21   stated that I subtracted the average daily yield on 30-year Treasury bonds over

22   the previous nine months from the value of the authorized return on equity in

23   each case to obtain the risk premium (JVW Rebuttal, page 85, lines 13-15).

1   However, I subtracted the average bond yield for the duration of the rate case

2   for each case, instead of a generic 9-month average yield for each case.

3   Q. DID DR. VANDER WEIDE AGREE WITH YOUR RISK PREMIUM

4   ANALYSIS?

5   A. While Dr. Vander Weide implicitly agreed with my use of authorized ROE as

6   the measure of return on equity, he raised several issues with respect to my risk

7   premium analysis. Among the issues he raised include (1) sample period, (2)

8   sample size, and (3) result of replicating my analysis using a large sample of

9   1449 decisions.

10 Q. WHAT IS THE SAMPLE PERIOD ISSUE?

11 A. Dr. Vander Weide claimed that my sample period included early 1980s cases

12   when there are more cases in that period than other periods. Dr. Vander Weide

13   stated my sample included disproportionately higher percentage of the cases

14   when interest rates were high and risk premiums were low and so that sample

15   period would have a disproportionate impact on my risk premium analysis of

16   the cost of equity (JVW Rebuttal, page 86).

17 Q. DO YOU AGREE WITH DR. VANDER WEIDE'S ASSESSMENT?

18 A. No, I do not agree with his assessment. I started my sample period in 1980 as

19   that is almost the beginning of the available data from Regulatory Research

20   Associate (RRA).

21   I have several issues with Dr. Vander Weide's objection. First, Dr.

22   Vander Weide failed to point to how the inclusion of the 1980s' data would

23   affect my risk premium estimates of the cost of capital. He implied that when

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1   we include the sample period of low risk premium, it would lead to low

2   estimated risk premium. However, this is not correct, as what we estimate is the

3   relationship between risk premium and interest rate. Second, for a valid

4   statistical analysis, the sample period should include time periods when interest

5   rates were high (thus risk premiums were low) and time periods when interest

6   rates were low (thus risk premiums were high) so we can have a better estimate

7   of the relationship between risk premiums and interest rates. Third, in order to

8   improve the efficiency in estimation, it is generally advised to use as many data

9   points as possible. The reason for that is when a larger sample is used, the

10   standard deviation of the estimate will be smaller, thus making the estimation

11   of the parameters more precise.

12 Q. WHAT IS THE SAMPLE SIZE ISSUE?

13 A. Dr. Vander Weide claimed that I have failed to include all relevant data in my

14   regression analysis. He stated that my regression is based on a dataset of 1033

15   decisions, while the workpapers show that there are 1449 available decisions.

16 Q. DO YOU AGREE WITH DR. VANDER WEIDE'S ASSESSMENT OF THE

17   SAMPLE SIZE?

18 A. No, I do not agree. The DESC rate case is a general rate case, thus I have

19   included all relevant past rate cases involving vertically integrated electric

20   utilities. The difference between the 1033 cases I used and presented in Exhibit

21   No.___(ZZ-8) and the 1449 decisions in the raw data set in the workpaper is

22   due to the exclusion of the phased-in and/or interim authorized cases.

1   However, even if we include those excluded cases, the ROE from the

2   risk premium model in my direct testimony still stands. Exhibit No. ____ (ZZ-

3   2, Surrebuttal) shows that the estimated risk premium from the model based on

4   a dataset of 1449 cases is 7.36% using the 1.44% 30-year Treasury bond yield.

5   A 7.36% risk premium plus 1.44% interest rate yields an expected return on

6   equity of 8.8% and it is almost the same as the 8.73% generated from my sample

7   of 1033 cases.

8   Q.   YOU HAVE GENERATED A ROE OF 8.8% FROM THE SAMPLE OF 1449

9   DECISIONS. HOWEVER, DR. VANDER WEIDE HAS REPLICATED

10   YOUR STUDY USING THE SAME SAMPLPE BUT GENERATED A ROE

11   OF 10.61% (JVW REBUTTAL, TABLE 9). CAN YOU EXPLAIN THE

12   DIFFERENCE?

13   A.   Dr. Vander Weide tried to replicate my study using the sample of 1449 cases,

14   but he ended up with a much higher ROE of 10.61%. There are two major

15   reasons. One is that he was not exactly replicating my study by using the data

16   of individual rate cases in the past. Dr. Vander Weide used all available

17   information (1449 cases) and then regressed the risk premium obtained by

18   subtracting the annual average yield on 30-year Treasury bonds from the annual

19   average allowed ROE (JVW Rebuttal, page 87). Table 9 in his rebuttal

20   testimony presented a final ROE of 10.61% from such a model. However, when

21   I regressed the risk premium obtained from subtracting annual average 30-year

22   Treasury bond yields from the annual average of authorized ROE on the annual

23   average of 30-year Treasury bond yields, I obtained an expected ROE of 8.9%.

1   While this number is close to my correctly calculated ROE of 8.8%, it is

2   ultimately an approximation by using the annual values of the variables.

3   However, the value of 8.9% is still 171 basis points below the value

4   reported in Dr. Vander Weide's Table 9 in his rebuttal testimony. This large

5   difference is the result of Dr. Vander Weide using an incorrect method to obtain

6   the parameter estimates of the risk premium models for my data in particular,

7   and for his estimation of risk premium models in general. So this is the second

8   reason why Dr. Vander Weide's ROE estimate is so much higher than the

9   correctly calculated ROE values.

10 Q.   CAN YOU EXPLAIN DR. VANDER WEIDE'S ESTIMATION METHODS

11   IN OBTAINING THE EMPIRICAL RELATIONSHIP BETWEEN RISK

12   PREMIUM AND INTEREST RATE?

13 A.   Yes, I can. When estimating the relationship between risk premium and interest

14   rate as the first step in estimating the required return on equity, Dr. Vander

15   Weide did not adopt the conventional Ordinary Least Square method (OLS).

16   Instead, he used the so-called Prais-Winsten (PW) method in an attempt to

17   correct for serial correlation (see JVW-2 Rebuttal Notes in reference to JVW-

18   6). Then, he used the estimated regression coefficients to compute the expected

19   risk premium, and to add the bond yield to the expected risk premium to obtain

20   the ROE estimate.

21 Q.   IS THERE A PROBLEM IN USING THE PRAIS-WINSTEN METHOD IN

22   OBTAINING THE REGRESSION COEFFICIENT?

1   A.   Yes, there is. As I have explained in Exhibit No.____ (ZZ-3 Surrebuttal), the

2   PW method is not appropriate in estimating the regression coefficient in such a

3   setting. When we use the empirical relationship between risk premium and

4   interest rate to project risk premium, we rely on the empirical relationship

5   between the level of risk premium and the level of interest rate. The PW method

6   obtains the parameter estimates based on the regression of

7   QUASIDIFFERENCED risk premium and QUASIDIFFERENCED interest

8   rate. This renders the interpretation of regression coefficients harder and creates

9   a practical problem in obtaining the projected risk premium. In addition, the

10   problem of serial correlation does not lead to the biased parameter estimate but

11   only leads to inefficient estimate of the standard error of the parameter

12   estimates. Regardless of the serial correlation problem, the relationship between

13   risk premium and interest rate is significant enough so the inefficient estimate

14   of the standard error does not cause any practical problems. In this case, we can

15   either choose to estimate the relationship between risk premium and interest

16   rate by using the OLS method or using the Newy-West method, which does not

17   alter the coefficient estimate to interest rate in the risk premium – interest rate

18   relationship.

19   Q.   WHAT IS THE CONSEQUENCE TO DR. VANDER WEIDE'S

20   ESTIMATION OF ROE BY THE RISK PREMIUM METHOD WHEN HE

21   USES THE PW METHOD?

22   A.   The use of the PW method generates incorrect parameter estimates for the

23   relationship between the risk premium and interest rate and biases the estimates

1   of the risk premium upward. In Dr. Vander Weide's replication of my risk

2   premium method result in Table 9, his method biases the result upward by 171

3   basis points. As I will also show later in this surrebuttal, Dr. Vander Weide's

4   risk premium model biases the estimate of ROE upward by 40 to 60 basis points

5   depending on which interest rate is used.

6 Q. WHAT IS THE OVERALL ASSESSMENT OF YOUR RISK PREMIUM

7   ANALYSIS BY DR. VANDER WEIDE AND DO YOU AGREE WITH HIS

8   ASSESSMENT?

9 A. Dr. Vander Weide concluded, in addition to the above objections, that my

10   recommendation is unreasonably low and should have been higher if I adjusted

11   the risk premium model generated ROE value by his "financial risk"

12   adjustment.

13   I do not agree with Dr. Vander Weide's assessment. As I have explained

14   above, Dr. Vander Weide's objections are based on an incorrect assessment of

15   my risk premium method and his erroneous estimation of the relationship

16   between risk premium and interest rate, in addition to the incorrect use of

17   forecasted interest rate, unjustified inclusion of flotation costs, and so-called

18   "financial risk" adjustment.

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1   IV. SURREBUTTAL OF DR. VANDER WEIDE'S RESPONSES TO MY

2   COMMENTS ON HIS ROE MODELING

3

4   Q.   DID DR. VANDER WEIDE PROVIDE RESPONSE TO YOUR COMMENTS

5   ON HIS ROE MODELING?

6   A.   Yes, he did. He provided his responses in five areas: (1) my critique of his use

7   of forecasted interest rate; (2) my critique of his use of analysts' forecasts as

8   the long term sustainable growth rate; (3) inclusion of flotation costs; (4) the

9   use of a comparable earnings model; and (5) his "financial risk" adjustment.

10   A. INTEREST RATE ADJUSTMENT

11 Q.   DID DR. VANDER WEIDE OBJECT TO THE USE OF CURRENT

12   INTEREST RATES IN HIS MODELS/

13 A.   Yes, Dr. Vander Weide objected to the use of current interest rates in his ROE

14   models. His arguments are two-fold: (1) the interest rate should be the one that

15   is effective during the rate effective period; (2) the current interest rates are

16   unreasonable estimates of the future interest rates as they are influenced by

17   current economic conditions and monetary policy. (JVW Rebuttal, page 89).

18 Q.   DO YOU AGREE WITH HIS ASSESSMENT OF THE INTEREST RATES?

19 A.   In principle, I agree with his first assessment and I do not agree with his

20   second assessment in the context of setting the ROE. When investors make

21   decisions at the present time, they consider all available information,

22   including the current and expected future economic conditions and monetary

23   policy. The market interest rates already reflect what the investors perceive

1   about the future whether the future is tomorrow or 5 to 30 years down the

2   road. As I have argued in my direct testimony, if investors expect the long

3   term (say 30-year Treasury bond yield) interest rates to be different in 2021

4   than today's long term interest rates, the interest rates would have changed to

5   reflect that perception.

6   Regarding the interest rates being affected by the current pandemic

7   and monetary policy, Dr. Vander Weide believes the current interest rates are

8   highly "distorted" (page 89, line 21 of JVW Rebuttal). I do not agree with Dr.

9   Vander Weide's argument and believe Dr. Vander Weide fails to distinguish

10   the response patterns of short-term and long-term interest rates.

11   It is true that the current short-term interest rate is very low due to the

12   Federal Reserve monetary policy, and the short-term interest rate may be

13   higher once the economic conditions improve. Even though we believe the

14   short-term interest rate may recover sometime down the road, the short-term

15   interest rates are still low today compared to perhaps one year later. This is

16   reasonable as the current short-term interest rates reflects the capital market

17   condition during the current investment periods rather than a year later.

18   However, it is different as far as the long-term interest rates are concerned. As

19   I have argued in my direct testimony, the long-term interest rates do not

20   respond significantly to the short-term economic stimulation unless investors

21   believe the policy has a long-term or long-lasting impact. In my direct

22   testimony, I provided a chart that shows the different paths of short-term

23   interest rates and long-term interest rates for the last 40 years (Exhibit No.___

1   (ZZ-2). It is clear that only the short-term interest rate (3-month Treasury bill

2   yield) responded cyclically to monetary stimulus and the long-term interest

3   rate (30-year Treasury bond yield) did not. The long-term interest rate simply

4   followed a downward trajectory with normal volatilities.

5 Q. DID DR. VANDER WEIDE OBJECT TO YOUR ARGUMENT OF HIM

6   USING THE EIA FORECAST TO GENERATE A HIGHER ROE FOR THE

7   COMPANY?

8 A. Yes, he did. Dr. Vander Weide argued that he used the forecast simply due to

9   the fact that the EIA interest rate forecasts are widely and freely available to

10   all investors. I have shown in my direct testimony that the EIA interest rate

11   forecasts were grossly biased upward, but Dr. Vander Weide did not provide

12   any evidence or argument that what I have presented is not correct. In his

13   update of the ROE result in the rebuttal, Dr. Vander Weide continued to use

14   the EIA interest rate forecast to generate his ROE recommendations.

15 Q. DID DR. VANDER WEIDE PROVIDE ANY RESPONSE TO YOUR

16   REPLICATION OF HIS ROE RESULTS GENERATED BY RISK

17   PREMIUM MODELS USING ONLY THE *VALUE LINE* FORECAST AND

18   THE CURRENT INTEREST RATES?

19 A. Yes, he did. He did point out an error in my replication of his *ex ante* risk

20   premium cost of equity calculation. I have updated my replication of his *ex*

21   *ante* risk premium cost of equity calculations and also presented the *ex post*

22   risk premium cost of equity as a single value, which is obtained as an average

23   of the values from his two *ex post* risk premium models. The result is

1   presented in Exhibit No._____ (ZZ-4 surrebuttal). As I have explained earlier,

2   the estimation method (PW method) that Dr. Vender Weide used to generate

3   the coefficients to obtain the estimated risk premium is inappropriate.

4   Therefore, I have also presented the risk premium ROE based on the correctly

5   estimated OLS results.

6   Dr. Vander Weide's *ex ante* RP model yielded a ROE of 10% using

7   the average forecasted interest rates from EIA and *Value Line*. Using the

8   *Value Line* forecasted interest rate alone, Dr. Vander Weide's RP ROE

9   declines to 9.84%. Using the current interest rate of 1.44%, Dr. Vander

10   Weide's *ex ante* risk premium model generates a ROE of 9.46%. With the

11   correction of the regression method, and therefore the corrected regression

12   coefficients, his RP ROE result further declines to 9.44% (*Value Line*

13   forecast) and 8.81% (current interest rate).

14   Using the interest rate forecasts from both EIA and *Value Line*, Dr.

15   Vander Weide's updated *ex post* risk premium ROE is 8.9%. Subtracting the

16   20 basis point flotation costs leads to an *ex post* RP ROE of 8.7%. Using only

17   the *Value Line* forecast leads to a reduced ROE of 8.27% and using the

18   current interest rate further reduced his ROE to 7.38%.

19   To summarize, my analysis shows that Dr. Vander Weide's updated

20   risk premium ROE results are 120 to 130 basis points higher than they should

21   be due to his incorrect use of interest rate and model estimate method.

22

23

1   B.   EPS GROWTH RATE FORECASTS IN DCF ANALYSIS

2 Q. DID DR. VANDER WEIDE COMMENT ON THE USE OF EPS GROWTH

3   FORECASTS IN THE DCF ANALYSIS?

4 A. Yes, Dr. Vander Weide continued to believe analysts' EPS forecasts should be

5   used as the growth rate in the DCF analysis, but he also questioned that the

6   use of GDP growth rate as a part of sustainable growth rate may not be known

7   or shared by investors.

8 Q. DO YOU AGREE WITH DR. VANDER WEIDE THAT EPS GROWTH

9   FORECASTS SHOULD BE USED SOLELY AS THE SUSTAINABLE

10   GROWTH RATE IN THE LONG RUN IN THE DCF ANALYSIS?

11 A. No, I disagree with his comments. The DCF model assumes an infinite

12   investment horizon and it requires a sustainable growth rate that goes beyond

13   a short horizon of 3-5 years. Dr. Vander Weide stated that studies

14   demonstrated that the analysts' growth forecasts are more highly correlated

15   with stock prices than any other growth forecasts. However, this does not

16   refute the fact that the analysts' EPS forecasts only span a period of 3 to5

17   years. I adopted a method, in my two-step DCF model, sanctioned by the

18   Federal Energy Regulatory Commission (FERC) to estimate the long-term

19   EPS growth rate which is a blended growth rates of analysts' projections and

20   GDP growth rate. It is typically assumed that in a multi-stage DCF model, the

21   last stage growth rate of the company is the same as the growth rate for the

22   overall economy. For example, Dr. Roger Morin in his book *New Regulatory*

23   *Finance* described a methodology: "For the first five years (Stage 1),

1   dividends are assumed to grow at the analyst consensus long-term earnings

2   growth forecast. From year 25 onward (Stage 3), dividends are assumed to

3   grow at the same nominal rate as the national economy, using either the long-

4   term economic forecast and/or the long-term historical growth rate of the U.S.

5   economy, as above." (Page 311). In my analysis, GDP growth projections

6   from the two sources (EIA and Social Security Administration) are used and

7   this information is widely available and free to investors.

8   C.   FLOTATION COSTS

9   Q.   DID DR. VANDER WEIDE CONTINUE TO ADVOCATE FOR THE

10   INCLUSION OF FLOTATION COSTS IN HIS ROE CALCULATIONS?

11   A.   Yes, he did. However, as I have argued in my direct testimony, Dr. Vander

12   Weide's arguments for the inclusion of flotation costs in his ROE is

13   inconsistent with the Company's position and the actual stock issuance costs

14   of DE associated with DESC. Specifically, as Exhibit No.___ (ZZ-9) from my

15   direct testimony shows, the Company admits: (1) No Dominion Energy

16   capital or debt issuance specifically targeted a use of proceeds to infuse equity

17   to DESC, (2) no costs of equity issuances in 2019 were associated with

18   DESC, and (3) no costs of equity issuances are being included for recovery in

19   this case. Thus, Dr. Vander Weide's request to include flotation costs as a part

20   of ROE is not reasonable.

21

22

23

1   <u>D. COMPARABLE EARNINGS ANALYSIS</u>

2 Q. HOW DID DR. VANDER WEIDE RESPOND TO YOUR OBJECTION OF

3   HIM USING THE COMPARABLE EARNINGS MODEL IN THE ROE

4   ANALYSIS?

5 A. Dr. Vander Weide responded by stating "the comparable earnings method is

6   designed to satisfy the United States Supreme Court's fair rate of return

7   standard in the *Hope Natural Gas* case that the 'return to the equity owner

8   should be commensurate with returns on investments in other enterprises

9   having corresponding risks.' " (JVW Rebuttal, page 95, lines 13-16).

10   I do not agree with Dr. Vander Weide's statement. Dr. Vander Weide

11   failed to elaborate how the comparable earnings method is designed to satisfy

12   the *Hope* standard. The *Hope* standard requires a measurement of the return

13   based on market activities and this is why investors determine the required

14   rate of return on equity by using the DCF model, CAPM models, and other

15   models based on market value analysis. The comparable earnings method is

16   based on the analysis of book value; thus it fails to meet the *Hope* standard.

17   As I also cited in my direct testimony, FERC regarded it as "thoroughly

18   discredited." (Zhu Direct, Page 61).

19   E.   MARKET VALUE CAPITAL STRUCTURE ADJUSTMENT

20 Q. DID DR. VANDER WEIDE PROVIDE ANY NEW ARGUMENTS FOR

21   THE MARKET VALUE CAPITAL STRCUTURE ADJUSTMENT OR HIS

22   SO-CALLED "FINANCIAL RISK ADJUSTMENT"?

1   A.   No, Dr. Vander Weide did not provide any new arguments for his last step

2   adjustment of the ROE, nor did he provide convincing evidence that any of

3   the regulatory authorities have adopted the market value-based capital

4   structure. As I have argued in my direct testimony, it is the general practice by

5   the commissions to use market value-based ROE applied to the book value

6   capital structure to obtain the cost of capital.

7   Q.   YOU ARGUED IN YOUR DIRECT TESTIMONY THAT THE MARKET

8   VALUE CAPITAL STRUCTURE ADJUSTMENT OF ROE IS NOT

9   APPROPRIATE, BUT EVEN IF ONE AGREED IT WERE A CORRECT

10   ADJUSTMENT, ONE SHOULD USE MARKET VALUE OF DEBT AND

11   EQUITY TO CORRECTLY CALCULATE THE MARKET VALUE

12   CAPITAL STRUCTURE. DID DR. VANDER WEIDE ADMIT THAT HE

13   USED THE BOOK VALUE OF DEBT IN CALCULATING HIS MARKET

14   VALUE CAPITAL STRUCTURE?

15 A.   Yes, he admitted that he used the book value of debt as a proxy for market

16   value (JVW Rebuttal, page 97, line 21). He defended his position by citing a

17   couple of statements by Brealey *et al* and Professor Damodaran (JVW

18   Rebuttal, page 97). The statement by Brealey *et al* suggests that "market value

19   of debt is usually not too far from book value," but does not define how far is

20   too far. This is similar to arguing that a 9.5% ROE is not too far from a

21   10.00% ROE. Professor Damodaran simply assumed the equality of market

22   value debt and book value of debt for his calculation of the industry sector

1   market value debt ratios. Dr. Vander Weide failed to provide any evidence

2   that the assumption is a correct one for any individual company.

3   I have argued in my direct testimony that when interest rates are

4   declining consistently, like we have experienced in the last 30 to 40 years, the

5   value of debt issued in earlier years when interest rates were higher is

6   expected to be higher due to the negative relationship between the value of

7   debt and interest rate. Thus, not calculating the market value of debt correctly

8   biases the market value equity ratio upward, leading to a higher adjustment for

9   ROE in Dr. Vander Weide's ROE analysis even when one agrees that the

10   adjustment is justified.

11   F.   DR. VANDER WEIDE'S ROE UPDATE

12   Q.   DID DR. VANDER WEIDE PROVIDE AN UPDATE OF HIS ROE STUDY?

13   A.   Yes, he did. He updated his study to include data up to October 31, 2020 to

14   reflect the most recent capital market conditions. His base ROE has declined

15   from 9.8% to 9.7%, and the "financial risk" adjusted ROE has declined from

16   10.4% to 10.3%.

17   Q.   DO YOU AGREE DR. VANDER WEIDE'S UPDATED STUDY REFLECTS

18   THE TRUE COST OF EQUITY THAT DESC FACES IN TODAY'S

19   CAPITAL MARKET?

20   A.   No. In reaching the final ROE recommendation, Dr. Vander Weide made

21   several assumptions and several adjustments to his models. As I stated in my

22   Direct Testimony, these assumptions and adjustments are not warranted and

23   lead to an upward bias of the true cost of capital for DESC.

1   Q.   AS DR. VANDER WEIDE HAS UPDATED HIS STUDY, HAVE YOU

2   UPDATED YOUR ANALYSIS OF HIS ROE RESULTS?

3   A.   Yes, I did. The result of my analysis is listed in Exhibit No.____ (ZZ-4,

4   Surrebuttal). First, I simply listed the ROE values from various models of Dr.

5   Vander Weide and then calculated the average ROE; then I subtracted the

6   unreasonable flotation costs of 20 basis points. I further calculated the ROE

7   based on Dr. Vander Weide's models by applying only the interest rate forecasts

8   from *Value Line*. Then I repeated the same procedure based on the current

9   interest rate. Finally, I calculated the *ex ante* risk premium ROE based on the

10   OLS estimation of the empirical relationship between risk premium and interest

11   rate and then presented the ROE results in the last two columns. As the result,

12   the average ROE values from Dr. Vander Weide's models with corrections are

13   in the range of 8.6% to 9.10%, consistent with my ROE recommendation of

14   9.1%.

15

16   V. CONCLUSION

17

18   Q.   CAN YOU SUMMARIZE THE RESULT OF YOUR ANALYSES?

19   A.   Yes. I have argued in this surrebuttal testimony that the ROE methods and

20   adjustments adopted by Dr. Vander Weide are flawed and erroneous. I have

21   argued against the use of forecasted interest rates, inclusion of flotation costs,

22   and "financial risk" adjustment among other things. After correcting those

23   problems, Dr. Vander Weide's models generated an average ROE very similar

1   to what I have recommended, and I believe a ROE in the neighborhood of 9.1%

2   is just and reasonable.

3 Q.   DOES THIS CONCLUDE YOUR SURREBUTTAL TESTIMONY?

4 A.   Yes, it does.

5

SUMMARY
OUTPUT

Regression Statistics	
Multiple R	0.876496818
R Square	0.768246673
Adjusted R Square	0.768086511
Standard Error	0.812124468
Observations	1449

ANOVA

	df	SS	MS	F	Significance F
Regression	1	3163.650005	3163.650005	4796.707551	0
Residual	1447	954.3632812	0.659546152		
Total	1448	4118.013286			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	7.943761257	0.053046527	149.750826	0	7.839704936	8.047817578
Interest Rate	-0.407629095	0.005885638	-69.25826702	0	-0.419174391	-0.3960838

Average Interest Rate for last 9 months:	1.44
Risk Premium	7.36
Expected Return	8.80

Replication of JVW Rebuttal Table 9

Year	Average of Authorized ROE	30-Year T-Bond Yield	Risk Premium
1980	14.2278	11.2725	2.9553
1981	15.2205	13.4479	1.7726
1982	15.7918	12.7627	3.0291
1983	15.3743	11.1560	4.2183
1984	15.3353	12.3832	2.9521
1985	15.1734	10.7351	4.4383
1986	13.9879	7.7771	6.2108
1987	12.9820	8.5763	4.4057
1988	12.7987	8.9428	3.8559
1989	12.9678	8.4362	4.5316
1990	12.6966	8.6028	4.0938
1991	12.5445	8.1310	4.4135
1992	12.0911	7.6629	4.4282
1993	11.4564	6.5913	4.8652
1994	11.2118	7.3711	3.8407
1995	11.5771	6.8787	4.6984
1996	11.4028	6.6993	4.7035
1997	11.3290	6.5999	4.7291
1998	11.7650	5.5732	6.1918
1999	10.7233	5.8684	4.8549
2000	11.5789	5.9348	5.6441
2001	11.1554	5.4897	5.6657
2002	11.2715	5.2824	5.9891
2003	11.3633	4.9197	6.4437
2004	10.8856	5.0290	5.8565
2005	10.6342	4.5683	6.0659
2006	10.6320	4.8765	5.7555
2007	10.5019	4.8357	5.6662
2008	10.4773	4.2656	6.2117
2009	10.6568	4.0700	6.5868
2010	10.4224	4.2489	6.1736
2011	10.3325	3.9038	6.4287
2012	10.1013	2.9185	7.1828
2013	9.9468	3.4456	6.5012
2014	9.9395	3.3366	6.6029
2015	9.7488	2.8412	6.9076
2016	9.7655	2.5978	7.1677
2017	9.8036	2.8930	6.9106
2018	9.6796	3.1102	6.5693
2019	9.7308	2.5862	7.1446
2020	9.5371	1.5349	8.0021

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.9413751
R Square	0.88618708
Adjusted R Square	0.8832688
Standard Error	0.47517768
Observations	41

ANOVA

	df	SS	MS	F	Significance F
Regression	1	68.56626753	68.56627	303.6676	5.29964E-20
Residual	39	8.805959304	0.225794		
Total	40	77.37222684			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	8.07920636	0.17164696	47.06874	5.61E-36	7.732017613	8.42639511
30-Year T-Bond Yield	-0.4283535	0.024581201	-17.4261	5.3E-20	-0.47807368	-0.37863333

Average Interest Rate for last 9 months:	1.44
Risk Premium	7.46
Expected Return	8.90

Method to Estimate the Relationship Between Risk Premium and Interest Rate

The Risk Premium (RP) model is one of the generally accepted methods to estimate the market required return on equity in utility rate cases. The basis for the RP model is that there are generally two kinds of investments that an investor can have: an investment in a relatively more risky utility and an investment in less risky asset, typically a risk-free asset such as government bonds which is free of default risk. Investing in a riskier asset requires additional compensation for bearing risks. This compensation for bearing risks is usually called risk premium.

Empirically risk premiums can be developed by taking the difference between return on equity and risk-free rate or yield on other less risky assets. There are various measurements of return on equity. A form of return on equity is obtained by calculating historical returns on stocks and then subtract the historical yield on less risky assets such as bond yield. A forward-looking RP can be obtained by a measure of market return from a forward-looking method subtracting current interest rate. Another commonly used method is to adopt returns on equity authorized from past utility rate cases as the return and then subtract risk free rate to obtain risk premium.

Once the risk premium is obtained, analysts employ the negative relationship between the risk premium and interest rate to project the risk premium for the future period. Note that this relationship is purely based on the empirical findings of the significant relationship between risk premium and interest rate. It is generally the case that no matter what interest rate is used to derive risk premium, the same interest rate must be used to obtain the projected return on equity. Thus, risk premium can be different when different interest rate is used to derive the risk premium. For example, with the same return on equity, using 30-year bond yield would generate

lower risk premium than using 3-month Treasury bill. However, due to the nature of long-term investment, yield on long term bonds should be the interest rate used to derive the risk premium as well as to generate expected return on equity.

As the result, the following relationship should hold: Expected Return on Equity = Expected Risk Premium + Interest Rate. The interest rate should be the interest rate effective for the investment period. However, due to the nature of the interest rate being unpredictable, the correct use of expected interest rate is the current interest rate.

Expected risk premium is usually obtained through a regression method in the following form:

$$RP = \beta_0 + \beta_1 Int + \varepsilon, \tag{1}$$

where RP is the dependent variable, Int is the interest rate or bond yield, β_0 and β_1 are coefficients and ε is a so-called classical error term. β_1 is an important parameter as it measures the quantitative relationship between risk premium and interest rate. Once the model is estimated, the following estimated model is usually presented with b_0 and b_1 being specific estimated values of β_0 and β_1 respectively:

$$RP = b_0 + b_1 Int + e, \tag{2}$$

where b_0 is the estimated value of β_0, b_1 is the estimated value of β_1, and e the estimated values of error term ε. Then the projected value of RP is obtained by the following formula:

$$\text{Projected } RP = b_0 + b_1 Int. \tag{3}$$

Issues can rise when model (1) is estimated by using the actual data. A typical problem is that the estimated value of e (residual) can be correlated over time. This is a so-called serial correlation problem. An intuitive explanation of the cause of correlated residual is that we can view e or the residual as a shock to the risk premium. Sometimes, the capital market can be hit

by an unexpected event or shock, and the effect of the shock would be carried over for several additional period. For example, COVID-19 shocked the U.S. economy as well as the capital market in March 2020 initially. However, the impact of the shock does not disappear in one period and we would expect the shock effect to last several periods before it dissipates. As a result, serial correlation of the residuals can be a common problem when we estimate a time series model like (1).

A method called Ordinary Least Square (OLS) is usually used to estimate model (1). However, OLS could generate residuals that show serial correlation in some regression analysis such as the regression analysis of risk premium on interest rate. When serial correlation is present, we may have a problem in correcting interpreting the significance of coefficient β_1.

Recall that β_1 measures the quantitative relationship between risk premium and interest rate. The general hypothesis is that β_1 is not equal to zero so there is a significant relationship between the two variables. However, that relationship is estimated with sample data and sample data may contain sampling errors. Therefore, it is very important to test empirically whether the hypothesized value would hold given the sampling error. The usual test is the so-called t-test which calculates the test statistic as the ratio of the estimated value b_1 to the estimated standard error of b_1. In a sense, the standard error of b_1 measures the variability of the estimated coefficient due to sampling error.

In the presence of a serial correlation problem, we may not be able to rely on the standard t-test to make inference about the true value of β_1. However, the b_1 estimate is still unbiased. What unbiasedness means is that if we had many samples, we would be able to generate many b_1s (one b_1 from each sample of many observations of RP and interest rate). The average value of the b_1 would be equal to the actual value of β_1. However, when there is a serial correlation

problem, the variability of the b_1 will be estimated incorrectly, so we will not be able to use the standard t-test to conduct the hypothesis testing regarding the value of β_1. To be precise, the presence of the serial correlation in the regression residual would lead to a smaller variability of the coefficient estimates than it actually is thus leading to more frequent rejection of the no relationship hypothesis. In our case, the presence of the serial correlation may cause us to conclude there is a negative relationship between risk premium and interest rate while there is not any. However, if there is indeed a negative relationship between risk premium and interest rate, the existence of the serial correlation does not cause any practical problem at all. This is indeed the case for the relationship between risk premium and interest rate. ***So practically there is no need to correct the serial correlation problem as the OLS parameter estimates are unbiased***.

There are several methods in statistics if one wants to correct the problem. One method is the so-called Cochrane-Orcutt (CO) method and a variation of it is called Prais-Winsten (PW) method. The CO or WP method proceeds as follows:

Step 1: Assume a first order serial correlation in the error term, so the model would look like the following:

$$RP_t = \beta_0 + \beta_1 Int_t + \varepsilon_t, \qquad \varepsilon_t = \rho\varepsilon_{t-1} + v_t \tag{4}$$

where t is a time subscript and v_t is the classical random error term that is free of serial correlation problem. ρ is the first-order serial correlation coefficient.

Step 2: Multiplying the risk premium equation in (4) by ρ, and lagging the equation by one time period, then the RP equation becomes the following one:

$$\rho\, RP_{t-1} = \rho\, \beta_0 + \rho\, \beta_1 Int_{t-1} + \rho\, \varepsilon_{t-1}, \tag{4'}$$

Step 3: Subtracting (4)' from (4), we would end up with the following equation:

$$(RP_t - \rho\, RP_{t-1}) = (\beta_0 - \rho\, \beta_0) + \beta_1(Int_t - \rho\, Int_{t-1}) + (\varepsilon_t - \rho\varepsilon_{t-1}) \qquad (5)$$

The term in the last parenthesis is equal to v_t, an error term that does not have any serial correlation problem.

Step 4: A regression is then run on the modified version of the model (1), i.e., a quasi-differenced risk premium (not the original risk premium term) is regressed on a quasi-differenced interest rate variable (again, not the original interest rate variable).

Note that the coefficient β_1 is still intact. Supposedly, the β_1 estimate should remain to be the same whether equation (1) or equation (5) is run. However, this is usually not the case. That is, the β_1 estimate from equation (5) often differs from the β_1 estimate from equation (1). According to Wooldridge (2002), when the β_1 estimate from equation (5) differs from the β_1 estimate from equation (1), it is usually caused by the correlated independent variable with the error term, a problem that renders the nice statistical properties of the CO or PW method not "nice" anymore. Therefore, in this case, the OLS regression of model (1) is better than the CO or PW regression. To quote Wooldridge (2002), "Our derivation shows that OLS and FGLS might give significantly different estimates because (12.35) fails. In this case, OLS – which is still consistent under (12.34) – is preferred to FGLS (which is inconsistent). If X has a lagged effect on y, or X_{t+1} reacts to changes in u_t, FGLS can produce misleading results." (Wooldridge, page 407). In the quotation, Y is the dependent variable such as risk premium, X is the independent variables such as interest rate and u is the error or shock term, and PW is one of the Feasible Generalized Least Square (FGLS) methods. The quotation has some references to statistical jargons and conditions; however, the conclusion is quite clear; i.e., OLS estimates should be used when OLS and PW (or FGLS) estimates are different.

Another way of correcting the serial correlation problem is through the estimation of the Newy-West standard error. The Newy-West standard error is serial correlation and heteroscedasticity consistent, which corrects the serial correlation problem (as well as another problem called heteroscedasticity) by addressing the problematic standard errors, not touching the unbiased β_1 estimate. This method is a preferred method to correct for serial correlation in the estimation of the risk premium-interest rate relationship if one chooses to correct the problem.

To summarize: (1) serial correlation problem does not affect the unbiasedness of the parameter estimate. (2) Correcting the serial correlation using the CO or PW method can lead to different parameter estimate than the OLS estimate. The PW-generated RP-Interest rate relationship cannot be interpreted intuitively as the regression is run on a quasi-differenced version of the variables, not the original RP and interest rate levels. (3) When the PW parameter differs from the OLS parameter estimate, the PW method is usually problematic. (4) Newy-West serial correlation consistent parameter can be estimated, which has the same estimated value as the OLS estimate. This way, the parameter estimate can maintain the original meaning and can be interpreted intuitively. (5) OLS estimation is a practical method to estimate the risk premium-interest rate relationship due to (i) the parameter estimate is unbiased, (ii), we do not expect zero relationship between risk premium and interest rate anyway, and (iii) the standard error of the parameter estimate is very small so the parameter estimate is statistically significant anyway; and making standard error estimate smaller than what it actually is in the OLS does not change the conclusion anyway.

Analysis of JVW Updated ROE

	JVW Rebuttal	Modifications					
	Table 1	[1]	[2]	[3]	[4]	[5]	[6]
Cost of Equity Model	Model Result	Exclude CE Model	Exclude Flotation Cost (-0.2%)	Exclude EIA Forecast	Use Current Interest Rate	Exclude EIA Forecast, OLS	Use Current Interest Rate, OLS
a. Discount Cash Flow	9.00%	9.00%	8.80%	8.80%	8.80%	8.80%	8.80%
b. Ex Ante Risk Premium	10.00%	10.00%	9.80%	9.64%	9.26%	*9.24%*	*8.61%*
c. Ex Post Risk Premium	8.90%	8.90%	8.70%	8.27%	7.38%	8.27%	7.38%
d. CAPM - Historical	9.50%	9.50%	9.30%	8.34%	7.80%	8.34%	7.80%
e. CAPM - Forward Looking	10.80%	10.80%	10.60%	10.45%	10.38%	10.45%	10.38%
f. Comparable Earnings	10.00%						
Average	9.70%	9.64%	9.44%	9.10%	8.72%	9.02%	8.59%

[1] JVW Table 1 excluding comparable earnings model
[2] = [1] - 0.2% flotation costs
[3] ROE results in [2] applying *Value Line* interest rate forecast only (excluding EIA interest rate forecasts)
[4] ROE results applying current interest rate to JVW models
[5] Same as [3] except OLS is applied to JVW ex ante risk premium model
[6] Same as [4] except OLS is applied to JVW ex ante risk premium model

a. Discount Cash Flow	JVW -1 Rebuttal
b. Ex Ante Risk Premium	JVW -2 Rebuttal
c. Ex Post Risk Premium	JVW -3 Rebuttal
d. CAPM - Historical	JVW -4 Rebuttal
e. CAPM - Forward Looking	JVW -5 Rebuttal
f. Comparable Earnings	JVW -6 Rebuttal